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GROWING FORAGE CROPS on Vancouver Island

DA DEPARTMENT OF AGRICULTURE

Table 1.—Recommendations for Seeding Grasses and Legumes on Vancouver Island

Species or mixture	Pounds per acre	Comments
	Perennial hay or silage	
1. Orchardgrass	6	On well-drained soils, seed grass in early fall, and clover
Perennial ryegrass	6	in February on frozen ground.
Red clover	6	On moderately drained soils, seed grass and clover in
Alsike clover	4	early spring.
2. Alfalfa, Vernal or Du Puits	15	Alfalfa is suitable for only well-drained soils. Seed it in early spring with no nurse crop.
3. Alfalfa, Vernal or Du Puits	15	
Orchardgrass	5	
4. Reed canarygrass	15	This grass is suitable for only poorly drained soils. Seed it in early spring.
	Permanent pasture	
5. Orchardgrass	12	Same as for No. 1 above.
Perennial ryegrass	12	
White Dutch or wild white clover[1]	3	
6. Reed canarygrass	15	Same as for No. 4 above.

[1]Use 2 pounds of Ladino clover in place of white Dutch or wild white clover for irrigated pastures.

KEYS TO BETTER FORAGES

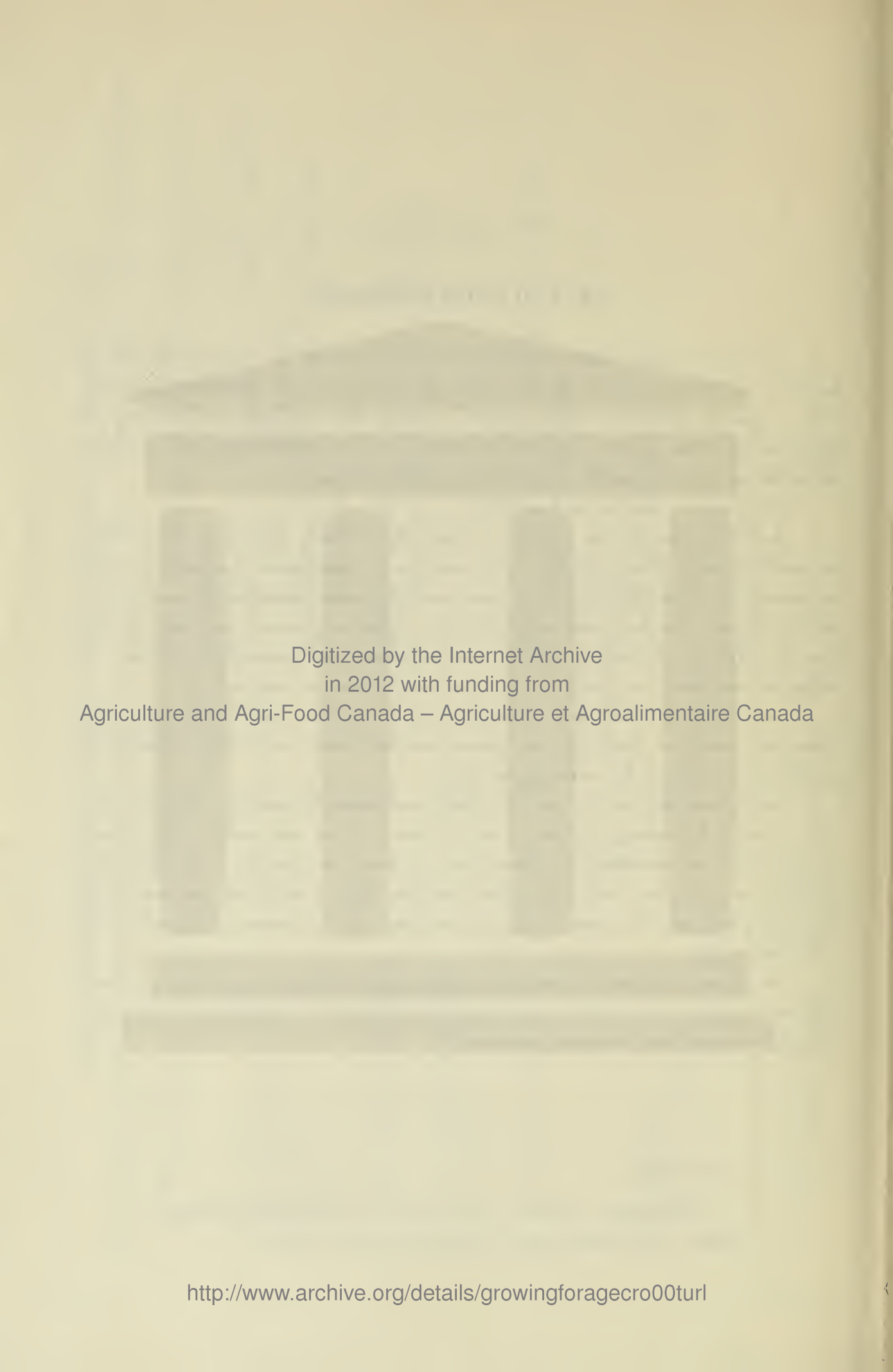
Dairying is the most important type of farming on Vancouver Island. In dollar value it accounts for more than 36 percent of all agricultural production. Locally grown hay and pasture provide the roughage for feeding the dairy herds. Most of the concentrate feeds are imported. Successful dairying depends on abundant production of high-quality herbage.

For high production and quality:

- Select the proper mixture to suit the climate and soil. Use alfalfa on well-drained, deep, friable soils and reed canarygrass on soils subject to prolonged winter flooding. Use late-maturing grass varieties in combination with red clover for hay, and early-maturing types for pasture and early silage. Use a mixture of Ladino clover, orchardgrass and perennial ryegrass for irrigated pastures. See page 2 for recommendations on seeding.
- Follow the fertilizer schedules given in this publication (page 15). Irrigated pastures fertilized as recommended have outyielded unfertilized plots by two tons of dry herbage per acre.
- Harvest hay early, cure it rapidly and store it quickly. High carotene and vitamin A content, indicated by the green color, are easily lost through overmaturity or weathering. Store hay as soon as curing is completed to avoid loss of leaves and color. Make silage when conditions are unsuitable for curing hay, and so save a larger percentage of the leaves, the green color and nutrients.
- Rotate pastures to prevent overgrazing. Mow after grazing to remove mature herbage and weeds. Chain-harrow to spread the droppings for the best possible return from improved pastures.

Cover photo

Herbage obtained from plots that were fertilized alike: left, grass alone; right, grass and clover.



GROWING FORAGE CROPS on Vancouver Island

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Forage crops are grown on 90 percent of the improved agricultural land on Vancouver Island and are used mainly for livestock feed. As dairying is the main source of farm revenue in this area, hay and pasture are the most important crops in the agricultural economy.

This publication deals with hay and pasture management. The recommendations are based on research conducted at the Experimental Farm, Saanichton, and on its experimental project farms at Cobble Hill, Duncan, Nanaimo, Courtenay and Alberni.

Vancouver Island has a mild marine climate with low summer temperatures and a long frost-free growing season that is particularly favorable for the growing of grasses and legumes. From March to May there is adequate precipitation for hay, silage and pasture production. The summers are dry and irrigation is necessary for optimum growth of forage crops.

Almost all the soils of Vancouver Island were developed under forest cover and most of them are low in organic matter and natural fertility. Cultivation depletes the organic matter rapidly and so causes the soil structure to deteriorate and also reduces moisture-holding capacity and availability of plant nutrients. Adequate manuring helps to maintain organic matter and returns some nutrients to the soil. Forage crops, because of their extensive root systems, are particularly useful for maintaining soil organic matter. In addition, legumes enrich the soil by fixing nitrogen from the air.

SUITABLE GRASSES AND LEGUMES

Grasses

Orchard, perennial rye and reed canary grasses are the only grass species recommended for hay and pasture crops. Many others, such as brome, meadow and tall fescues, have been found inferior to those recommended. It is best

not to include "bottom grasses" in a mixture. If they survive they reduce the yield of the more productive forage species by excessive competition.

Orchardgrass.—Over a wide range of soil and climatic conditions on Vancouver Island, orchardgrass is the most productive hay and pasture species. It is a bunch-type perennial that resumes growth early in the spring, carries well into the dry summer season and revives in the fall more quickly than most other grasses. It is the most shade-tolerant of the forage grasses in common use and one of the most productive under irrigation.

Akaroa and Oron are vigorous, early varieties recommended for pasture. Aberystwyth S.143 and Hercules mature later than Akaroa. They mature at the same time as red clover and combine well with it for a hay mixture.

Perennial ryegrass.—This is also a bunch-type grass. Its bunching, however, is not as pronounced as in orchardgrass and it forms a more compact turf. It establishes very quickly from seed but is short-lived. This grass gives good yields of nutritious forage but is usually not as productive as orchardgrass. It is more tolerant of wet conditions than orchardgrass and produces an abundance of spring pasture.

Thirty-two varieties of perennial ryegrass have been tested at Saanichton in recent years and none was markedly superior to the ordinary commercial type.

Reed canarygrass.—This is a long-lived perennial that spreads by underground stems to form a dense, strong turf. It is useful for areas subject to prolonged flooding in winter or with a high water table in summer. Since this grass is slow to become established it should be seeded as early in the spring as possible. When used for hay, the first cut should be made early to avoid coarseness.

Six varieties tested at Saanichton during the past few years yielded no more hay than the ordinary commercial type.

Legumes

Red, alsike and white clovers, and alfalfa, are the only legumes recommended for forage production on Vancouver Island. Alfalfa and red and alsike clovers are used principally in hay mixtures, and white clover is used mainly for pasture.

Alfalfa.—Alfalfa is a tap-rooted perennial adapted only to well-drained, deep, friable soils. It is drought-resistant and yields an abundance of highly nutritious forage under suitable conditions. Yields on unirrigated land at the Experimental Farm averaged 4.5 tons of hay per acre over a four-year period.

Thirty-four varieties have been tested at Saanichton over the past seven years. Vernal and Du Puits are recommended.

Double-cut red clover.—This clover is the most widely used legume in hay mixtures on Vancouver Island. It is adapted to the climate and all the main soil types except where severe flooding occurs. As the name "double-cut" implies, two crops can be harvested in one year. Being a biennial, red clover produces the heaviest yield of forage the second year after planting and then dies.

Twelve varieties have been tested in recent years. La Salle is recommended.

Alsike clover.—Alsike, a short-lived perennial, is more persistent in hay mixtures than red clover. It requires more moisture than red clover and thrives in wetter locations. Only under wet conditions does it outyield red clover.

White clovers.—The white clovers may be separated into dwarf and tall types. Wild white and white Dutch clovers are dwarf. They are persistent perennials recommended for unirrigated dryland pastures in all areas of Vancouver Island not subject to prolonged flooding. They are drought-resistant and stand up well under close grazing. They provide a highly palatable and nutritious forage and the stand usually thickens when pastured.

Ladino clover, on the other hand, is a tall strain of white clover. It is not as drought-resistant as the dwarf white clovers but is more productive under irrigation. Ladino is recommended in all mixtures for irrigated pasture and hay.

Mixtures are more desirable for forage production than pure stands of either grasses or legumes. Legumes increase the yield of grasses by increasing the supply of nitrogen in the soil. Grasses in a mixture make the turf more durable and reduce the incidence of bloat. Recommended mixtures with rates and dates of seeding are shown in Table 1.

ESTABLISHING THE STAND

Preparing the Land

A fine, firm and moist seedbed facilitates seeding at the proper depth, and favors rapid and uniform germination and establishment of the forage seedlings. It should be free from weeds to keep them from competing with the seedlings.

Seeding

Choosing the seed.—Use only top-quality graded seed of the recommended variety. Grades are established under the Seeds Act and guarantee

purity, germination and general quality. Ungraded, cheap seed gives disappointing stands of forage and introduces weeds.

Sowing.—Sow grass and legume seed at a depth of half an inch or less on a moist, firm and well-prepared seedbed.

Preferably use a grass seeder with a V-type packer. If you broadcast the seed or use a grass seeder attachment on the grain drill, follow the seeder with a harrow and a packer.

The proper time to seed grass and grass–legume mixtures depends on weather and soil moisture conditions.

On well-drained soils, sow the grass or the grass part of a mixture in early September, when there is adequate moisture for germination and establishment. Broadcast inoculated clover seed when the soil is honeycombed by frost early in February. When the soil thaws, the honeycomb will break down and cover the clover seed.

On moderately or poorly drained soils, sow both grasses and clovers in the spring as soon as a good seedbed can be prepared.

Alfalfa has more exacting seeding requirements than most forage crops. Failure to meet these requirements will give disappointing stands. Strict observance of the following points should ensure establishment:

- Sow only on a deep, well-drained soil. Alfalfa will not tolerate wet feet.
- Sow only on a firm, clean seedbed. Alfalfa seedlings do not stand competition from other plants. Mow off weeds that appear above the alfalfa.
- If you use a mixture, sow the alfalfa in the spring and overseed with the grasses in the fall. This eliminates competition between the two kinds of seedlings.
- Always inoculate the seed with the proper inoculum.

Nurse Crops

Nurse crops can be used to advantage if they are removed while soil moisture is still abundant. If you let a nurse crop grow to maturity, all the forage seedlings may die. On well-drained, droughty soils, nurse crops are not recommended.

Harvest the nurse crop for silage only or graze it very lightly. To aid establishment of the forage crop, irrigate the field as soon as you remove the nurse crop.

LIME FOR FORAGES

A light dressing of lime increases the yields of irrigated and dryland legumes on most of Vancouver Island. However, little response can be expected

from lime on the Saanich peninsula.

Use of lime helps to:

- Reduce soil acidity.
- Increase the availability of soil nutrients.
- Improve the physical condition of the soil.
- Increase the yield of the legume in a grass–legume mixture.

Broadcast lime at 1 ton per acre six months before seeding a grass–legume mixture. Repeat the application at the same rate every four years on long-term pasture or hay fields, at any time of the year when machinery can be driven over the fields.

MANURE

Barnyard manure is particularly valuable for maintaining soil organic matter and improving the soil structure. It is important to take proper care of manure and so return to the soil as much humus and plant food as possible. Restoring humus to mineral soils increases their ability to retain chemical fertilizers and helps to ensure uniform release of nutrients to the plants.

On organic soils, manure should be applied in the early years of development to provide minor elements and to introduce microorganisms that decompose the peat. Continued manuring is not recommended as it causes excessive decomposition, breakdown of the soil structure, and increased subsidence or settling and therefore drainage problems.

CHEMICAL FERTILIZERS

Dryland Mineral Soils

For unirrigated mineral soils south of the Malahat, use only nitrogen fertilizers since phosphate and potash fertilizers usually increase the yields very little. Broadcast ammonium nitrate in early March at 200 pounds per acre or the equivalent, to supply 66 pounds of nitrogen per acre.

In the Duncan, Nanaimo, Courtenay and Alberni areas, use a complete fertilizer containing nitrogen, phosphorus and potassium for grass–legume mixtures. For new plantings, drill 350 pounds of 13-16-10 per acre in with the seed. For first-year and established stands, broadcast 13-16-10 in March at the same rate. Detailed fertilizer instructions are given in Table 2.

Irrigated Mineral Soils

Nitrogen.—Nitrogen substantially increases the yields from pure grass stands. Three applications totaling 270 pounds of nitrogen (810 pounds of

33-0-0) per acre gave yields of 6,400 pounds of dry matter per acre per year in comparison with 1,300 pounds for unfertilized plots. With a good stand of inoculated legume, however, a hay crop requires only 90 pounds of nitrogen per acre while pasture may profitably use up to 145 pounds per acre per year.

Nitrogen is rapidly depleted by the forage plants and little remains a month after application. For uniform, summer-long forage production, apply nitrogen and irrigate after each cutting or grazing cycle.

Phosphorus.—In the areas north of the Malahat, Vancouver Island soils are low in phosphorus, and the addition of 60 pounds of phosphate (P_2O_5) per acre has increased forage yields markedly. Higher rates have not given any additional increase.

Potassium.—Potassium fertilizers are essential for all irrigated forage crops on Vancouver Island. In long-term tests, potash-treated plots have given higher and higher yields than untreated plots each year as the untreated plots became more deficient. Three applications totaling up to 200 pounds of muriate of potash (120 pounds of K_2O) per acre have given profitable returns.

Nutrient balance.—A proper balance of nitrogen, phosphorus and potassium is essential for best returns from fertilizer. Little response can be expected from fertilizers if one of the major nutrients is lacking. To ensure balance, apply these nutrients as follows:-

For irrigated grass–legume hay:

For new seedings, apply 13-16-10 at 350 pounds per acre drilled in with the seed.

On first-year and older stands, apply 13-16-10 at 350 pounds per acre in early spring. After the first cut, apply 150 pounds of 33-0-0 per acre and irrigate.

For irrigated grass–legume pasture:

For new seedings, apply 13-16-10 at 350 pounds per acre drilled in with the seed.

On first-year and older stands, apply 13-16-10 at 350 pounds per acre in early spring. On June 1, apply 33-0-0 at 100 pounds per acre and 0-0-60 at 50 pounds. On July 1 and August 1 apply 33-0-0 at 100 pounds per acre. Irrigate after each fertilizer application.

Organic Soils

Organic soils need heavy applications of chemical fertilizers for maximum production of forage. Tests so far indicate that more nitrogen and potassium are needed than are provided in 450 pounds of 4-10-10 per acre for infertile peats, 300 pounds of 2-15-15 per acre for moderately fertile peaty

mucks and 300 pounds of 0-15-15 per acre for highly fertile mucks. Since the organic soils vary greatly in the nutrients available, use test strips to determine the best rates for your land.

IRRIGATING FORAGE CROPS

About 3,000 acres of forage crops are under irrigation on Vancouver Island and 500 acres more are planned.[1] Irrigation improves:

- Yields,
- Survival of Ladino clover,
- Feed value,
- Soil structure.

Adequate irrigation doubles the yields of most crops. A dryland pasture on the Experimental Farm at Saanichton yielded 2.5 tons of dry matter per acre, produced mainly during May, early June and late September. A total of 5 inches of water in five applications increased the yield to 3.7 tons and a further 5 inches increased it to 5.2 tons.

Without irrigation, forage production is extremely poor from June 15 to September 15. Irrigation ensures good pasture throughout the summer, a very important factor in a fluid-milk producing area.

In a grass–clover mixture, Ladino clover survives only under irrigation or in areas otherwise supplied with adequate summer moisture. See "Nitrogen" on page 9 on the importance of the legume in the mixture.

Irrigated forages usually contain a higher percentage of protein than do unirrigated forages. Also, a higher legume content increases the protein content further, and irrigated forages can be cut earlier and at a more nutritious and digestible stage.

Heavy yields of irrigated forage crops allow a large return of farmyard manure to the soil. This improves the soil structure, which in turn means better tilth, easier cultivation and higher moisture-holding capacity. When manure and chemical fertilizers are both used and legumes are grown, the extra moisture provided by irrigation ensures maximum yields.

Sources of Irrigation Water

Irrigation water may be supplied from lakes, streams, dams, dugouts or groundwater sources. The Water Rights Branch of the British Columbia Department of Lands and Forests issues licences to regulate the use of irrigation water from lakes, streams and dams. Expansion of irrigation from these sources is being studied, but at present irrigation on Vancouver Island can expand

[1] Personal communication from A. Hall, B.C. Electric Co., Victoria, B.C.

only by impounding local run-off water or by the use of groundwater sources such as occur in the Koksilah area.

Irrigation Requirements

Summer rainfall is inadequate for forage crops on the east coast of Vancouver Island. In the Duncan area, the irrigation requirements[2] of grass–clover pastures on various soil types were determined in a four-year test. The alluvial Chemainus sandy loam, fine sandy loam and very fine sandy loam required an average of 7.5 inches, and Fairbridge clay loam and Cowichan clay required 10.5 inches. The yields on these irrigated pastures under recommended fertilizer practice averaged 9,000 pounds of ovendry forage per acre.

Drainage and height of the water table also affect irrigation requirements. Organic soils have a low requirement because of their large reserve of available moisture and often a high water table. Gravelly soils, because of their low moisture-holding capacity, need more frequent and lighter irrigations than do loam soils.

Irrigation requirements were estimated from weather records for various sites as follows: Sidney, 10.2 inches; Duncan, 9.7 inches; Nanaimo, 8.6 inches; Parksville, 9.0 inches; Courtenay, 7.7 inches; and Alberni, 5.7 inches.[3]

When to Irrigate

Start the first irrigation cycle of the season early enough so that you reach the last field before it begins to suffer from lack of moisture. Start subsequent cycles as soon as a sample of soil taken at a depth of one foot and squeezed into a ball does not retain its shape when bounced lightly on the palm of the hand. To make an auger for taking soil samples, weld a 3-foot extension with a T handle to a 1-inch wood bit. Electrical resistance blocks, tensiometers and evaporimeters are also useful for determining when irrigation is required.

HARVESTING AND GRAZING

Hay

Hay is the basic feed for the dairy and livestock industry on Vancouver Island. The value of the crop depends on quality. High-quality hay must be highly nutritious and palatable to livestock. To ensure quality, hay must be

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[2]The irrigation requirement is the total amount of water needed during the growing season for normal plant growth beyond that supplied by rainfall and soil-moisture reserves.

[3]Day, J. H., L. Farstad and D. G. Laird. Soil survey of southeast Vancouver Island. B.C. Soil Survey Report No. 6, 1959.

properly harvested and stored.

It is important to harvest hay at the proper stage of growth as it rapidly loses quality as it matures. The best time to cut grass is just after the pollen starts to fly. It is best to cut legumes when a tenth of the flowers have opened.

To preserve the quality of hay, cure and store it as quickly as possible. Quality is lost mainly from weathering, which causes leaves and stems to deteriorate, or from too much handling, which causes loss of leaves. The quicker hay can be raked, cocked or baled, the better the quality. In good haying weather this can be done in two or three days.

Silage

As the weather on Vancouver Island is often unfavorable for curing early-cut hay, the first cut is commonly ensiled. Silage is stored moist and does not require the same degree of curing as hay. The recommended moisture content for storing silage is 65 to 75 percent whereas for hay it is below 20 percent.

For silage, harvest legumes in the early-bloom stage, and grasses during the early heading or pre-flower stage. At this stage of maturity the forage has about 80 percent moisture. A short wilting period in which the crop loses 10 to 15 percent moisture puts the forage in an ideal condition for ensiling.

To obtain high-quality silage, the degree of packing varies according to the moisture content of the crop. In very young, lush crops, the high moisture content is offset by a longer wilting period, by a longer length of chop and by a moderate degree of packing. As the crops become more mature and the moisture content decreases, increase the packing to eliminate the air. At full bloom, compaction becomes extremely important and difficult to obtain but is facilitated by using a shorter length of chop.

Preservatives are unnecessary under ideal conditions but they are useful when excessive moisture cannot be avoided. Some suitable preservatives are: hay, chopped grain, molasses and sodium metabisulfite.

Pasture

Pastures provide the cheapest form of livestock feed, and careful management pays big dividends. During the first year the pasture should *not* be grazed until it is well established. If grown without a nurse crop, a light-to-medium hay crop may be harvested or grazed lightly in the fall if the ground is dry.

Overgrazing seriously injures established pastures, as most forage species do not survive constant clipping. It reduces the total amount of forage

produced and favors weeds. Continuous grazing reduces the reserves of food in the roots until the plants die. Rotational grazing allows time after pasturing for adequate regrowth of desirable species.

Divide pasture fields into a number of paddocks, the area depending on the size of the herd and whether or not the pasture is irrigated. Graze enough livestock in one enclosure at the same time to remove the herbage quickly, and change paddocks before overgrazing is apparent. Allow enough time for recovery of the forage species before regrazing.

To keep the pasture producing at a high level:

- Let the stand get 8 to 10 inches high and then graze it off quickly, leaving a 3-inch stubble to ensure rapid recovery.
- Mow the paddock after grazing to control weeds and to remove ungrazed mature herbage, and so induce more young and succulent growth.
- After each grazing period, break up and distribute the droppings over the pasture with a chain or brush harrow. This helps to avoid coarse clumps of unpalatable forage around the droppings.
- Fertilize and irrigate immediately after each grazing period.
- Keep livestock off soggy pasture to prevent puddling of the soil and damage to the grass and legume roots.

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Table 2.—Fertilizer Recommendations for Vancouver Island

Approved by Regional Co-ordinating Committee

Crop	Pounds of plant food per acre			Fertilizer		Remarks
	N	P_2O_5	K_2O	Kind	Pounds per acre	
SAANICH PENINSULA–VICTORIA–SOOKE (not irrigated)						
SILAGE, HAY OR PASTURE	66	0	0	33-0-0	200	Broadcast in the spring, March 1 to 15. No fertilizer is required on established stands with over 20 percent legume.
OTHER DISTRICTS (not irrigated)						
HAY, SILAGE AND PASTURE						
New seedings	45	56	35	13-16-10	350	Drill in with the seed.
First-year and established stands	45	56	35	13-16-10	350	Broadcast in early spring.
Peat and Muck Soils						
HAY, SILAGE AND PASTURE	18	45	45	(A) 4-10-10	450	Use A on the infertile peat soils, B on moderately fertile peaty mucks, C on highly fertile mucks. Drill in with seed. On established stands, broadcast in early spring.
	6	45	45	(B) 2-15-15	300	
	0	45	45	(C) 0-15-15	300	
Irrigated Crops on Mineral Soils						
HAY						
New seedings	45	56	35	13-16-10	350	Drill in with the seed.
First-year and established stands	95	56	35	13-16-10 plus 33-0-0	350 150	Apply in early spring. Apply after cutting but before irrigating.
PASTURE						
New seedings	45	56	35	13-16-10	350	Drill in with the seed.
First-year and established stands	145	56	65	13-16-10 plus 33-0-0	350 300	Apply in early spring. Apply 100 lb. per acre on June 1, July 1 and August 1, immediately before irrigating.
				0-0-60	50	Apply on June 1.

Copies of this publication may be obtained from:

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